ENVIRONMENTAL VARIABLES AS DETERMINANTS OF STUDENTS ACHIEVEMENT IN BIOLOGY SECONDARY SCHOOLS IN SOUTH WEST NIGERIA

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ABSTRACT

This study investigated the impact of selected environmental variables as determinants of students' achievements in biology in secondary schools. The selected environmental variables are class size and laboratory adequacy. The purpose was to find out whether these environmental variables can bring about improvement in the learning of biology by Senior Secondary School Students. The study design used was descriptive research of the survey type. Two instruments were used that is, Biology Achievement Test and School Environment Questionnaire .The population of the study consisted of all Biology students in both public and private Senior Secondary Schools class III(SSIII) in all the three selected states in South West Nigeria. A sample of 900 Biology students and 45 Biology Teachers from both public and private Senior Secondary Schools Class III. Two research hypotheses were generated for the study. The data collected were subjected to both descriptive statistics of mean and standard deviation; and the inferential statistics of regression Analyses was employed to test the hypotheses formulated.

From the results, it was revealed that the selected environmental variables had influence on the students' achievement in biology.

Keywords: Environmental variables, Determinants, Students' achievement, school science

INTRODUCTION

Science educators in developed countries have recognized the role of environmental variables as they affect academic achievement of students. Students' achievement in science has been found to depend to a large extent on school environmental variables such as laboratory adequacy and class size. Krueger (2000) and Barnejee, Abhijit, Shewn, Duffo and Leigh(2005) who exploited random seal experimental condition in Tenesse (U.S) and in two cities in India respectively. They found out that class size has no significant effect on the achievement of students. Angrist and Levy (1999), Hoxby (2001) and Urquiola (2006) used maximum class size rules with data from Israel and Bolivia, and they found a significant effect of class size reduction on achievement.

The issue that needs to be clarified more is what number of students make a large group and what should constitute a small group. Ajewole (1995) reported by Bilesanmi(2012) in her inaugural lecture disclosed that although the recommended teacher–pupil ratios are 1:3 for primary and 1:35 for secondary schools in Nigeria but, observations in many states revealed between 1:50 and 1:85.Glass and Smith, as the authors collected and summarized nearly 80 studies of the relationship of class size with academic performance that yielded over 700 class size comparisons on data from nearly 900,000 students. The two primary conclusions drawn are:

(i) Reduced class size can be expected to produce increased academic achievement and

(ii) The major benefits from reduced class size are obtained as the size is reduced below 20 students.

Bennett (1997), in a review of research, found broad agreement among researcher on the following general conclusion:

- Smaller classes result in increased student-teacher contact.
- Smaller classes appear to result in greater achievement gains for students with lower academic ability and for those who are economically or socially disadvantaged.
- Classroom management improves in smaller classes (fewer discipline problems).
- Smaller classes result in higher teacher moral and reduced stress.
- Individualization is more likely to occur in smaller classes.
- Very small classes of five or fewer students produce considerable higher achievement. Back in Nigeria Adeyefa (2000) found in her study that large class size is unconducive for serious academic work. Also Afolabi (2002) found no significant relationship among class size and students' learning outcomes.

Laboratory as seen in the context of this research can be described as a room or a building specially built for teaching, by demonstration of theoretical phenomena in practical terms. With the laboratory experience, students will be able to translate what they have read in their texts to practical realities, thereby enhancing their understanding of the learnt concepts. Faronbi (1998) argued the saying that 'seeing is believing' as the effect of using laboratories in the teaching and learning of science and other science-related disciplines as students tend to understand and recall what they see more than what they hear .

Ango cited in Owoeye (2000) stated that laboratory work, among others;

a. stimulates learner's interests as they are made to personally engage in useful scientific activities and experimentation;
b. affords the learner the basic skills and scientific method of solving problems.
c. promotes long term memory of the knowledge obtained.

When students are exposed to practical activities, they are stimulated and after, develop confidence and ability in problem solving (Raimi, 1998). Researchers such as Bajah (1984), Oguniyi (1996) and Bilesanmi-Awoderu (2000d) have established that, students learn by rote and are unable to apply knowledge to new and unfamiliar situations. This method of instruction, no doubt, falls short of the principle of modern learning theory goals of science education, which stresses students' active involvement in the teaching-learning process. Gilbert (1994) and Hodson (1996) also lent credence to the significance of practical work in the learning of science. In their submission, they identified six major significance of practical work in promoting effective learning of science, including biology. These are:

i. motivating students by stimulating interest and enjoyment,
ii. teaching laboratory skills,
iii. assisting concept acquisition and development,
iv. developing and understanding of scientific inquiry and developing expertise in conducting inquires;
v. encouraging social skills development

vi. inculcating the so- called scientific attitudes.

Every school must have a separate well - equipped standard laboratory for integrated science, Biology, Agricultural science, Chemistry and Physics (Federal Ministry of Education, 2002).The situation in school is contrary, several schools have a general laboratory. This single laboratory is used for all sciences (Ajayi, 2000, Ajayi 2007).Such situation where a single hill equipped room is being used as the laboratory for all sciences would definitely be highly inadequate and improper for effective learning since each science subject has its own peculiarity. Adeyegbe (2005) listed laboratory–adequacy as one of the factors that affect the leaning outcomes of students. In terms of academic achievement, Soyibo and Nyong also reported in Owoeye (2000) that schools with adequate and well - equipped laboratories have better results in the certificate examinations than those that are ill-equipped.

From the fore- going it can be inferred that practical activities motivate students and are a major attraction for them to study science, particularly biology. Not only this, it can also be deduced that without adequate laboratory equipment and specimen, there is little or no practical activity that could take place; and consequently any meaningful achievement in biology by the students will be a mirage.

The achievement of students has been a source of concern; our students are not achieving as well as are expected of them. The researchers observed that the school environment of most secondary schools in South West Nigeria seems not to be supportive when it comes to the teaching of science in which biology is not an exception. The laboratory where the students suppose to carry out the practical works are not serving the purpose, it is rather being used by science teachers as staff room. The issue of separate laboratory for science subject is very scarce in the school. The number of students in the class matters a lot in the teaching of science where demonstration methods of teaching suppose to be the order of the day.

The study seeks to find out whether environmental variables can bring about improvement in the learning of biology by students. The study investigated the impact of environmental variables on students' achievement in secondary school biology.

The following hypotheses were generated for the study:

1. There is no significant influence of class size on students' achievement in biology.
2. There is no significant influence of laboratory adequacy on student achievement in biology.

Methodology

Research Design

The research design was a descriptive research of the survey type. The study sought to determine students' achievement (dependent variable), using selected environmental variables (independent variables). This type of research design was chosen because the researcher has no direct control over the independent variables as they have manifested already. The population for the study comprised all Biology students and Biology teachers in Senior Secondary Schools class III , both in public and private Senior Secondary Schools in South- West, Nigeria.

Sample and Sampling Techniques

The sample for the study comprised 900 Biology students selected from 45 private and public senior secondary schools in South-West Nigeria schools. Students for the study were selected randomly through multistage and purposive sampling techniques across the three senatorial districts of the state in South West Nigeria. Students comprising 10 male and 10 female students were selected from each school. To cater for location, schools in the local government headquarters were selected to serve as urban area and schools from other towns in the local government as rural locations.

Research Instruments

Two types of instruments were used to collect relevant data for the study. These are; Biology Achievement Test (BAT) and School Environment Questionnaire (SEQ).Biology Achievement Test (BAT) was a 50-item multiple choice test with four options A, B, C and D compiled by the researcher from past questions of Senior School Certificate Examination (SSCE), conducted by WAEC and NECO. This enabled the researcher to determine the achievement level of students in biology. School Environment Questionnaire (SEQ) consisted of 20 items developed by the researcher to collect information intended to measure the school environment. The two factors were class size and adequacy of a biology laboratory.

Validity of the Instruments

The content validity of the instruments was ensured by comparing the items with those from consultation with the literature on the universe of the variables of interest in the study. Furthermore, four experts in science education were consulted and requested to judge the relevance and usability of the items for the purpose of the study

Reliability of the Instruments

The Biology Achievement Test (BAT) consisted of past questions on Biology from WAEC and NECO. Thus, it was a standard test. The reliability of SEQ was ensured through test retest method using Pearson Product Moment Correlation Statistics. The result showed the reliability co-efficient of 0.65 at 0.05 level of significant.

Results

The data collected were analysed using multiple regression analysis. The hypotheses were tested at 0.05 level of significance.

HO_1**:** There is no significant influence of class size on students' achievement in Biology.

Table 1: Regression analysis of class size and students' achievement in Biology.

Model	B	Std error	Beta	T	Sig. T	R	R^2	F
Constant	31.207	1.322		23.604	.000	.609	.371	48.918
Class size	-.271	.039	-.609	-6.994*	0.000			

*P <0.05

The result in Table 1 indicates that there is a statistical significant influence of class size on the achievement of students in Biology (t= -6.994, P<0.05). The null hypothesis is rejected. There exists high, positive relationship between class size and students' achievement in Biology (r = 0.609, P<0.05). About 37% (r^2 = 0.371, P<0.05) of the variation in students' achievement in Biology is explained by class size. The overall regression model is statistically significant at 0.05 level (F = 48.918, P<0.05).

HO_2: There is no significant influence of laboratory adequacy on students' achievement in Biology.

Table 2: Regression analysis of laboratory adequacy and students' achievement in Biology.

Model	B	Std error	Beta	t	Sig. T	R	R^2	F
Constant	28.572	4.774		5.985	.000	.144	.021	1.745
Laboratory Adequacy	-.201	.152	-.144	-1.321	.190			

P>0.05

Table 2 shows that the influence of laboratory adequacy on the achievement of students' in Biology is not statistically significant at 0.05 level (t= -1.321, P> 0.05). The null hypothesis is accepted. The relationship between laboratory adequacy and students achievement in Biology is low and not statistically significant at 0.05 level (r = 0.144, P>0.05). Laboratory adequacy contributed about 2% (r^2 = 0.021) of the variance in students' achievement in Biology.

Discussion

The result of the analysis of hypothesis one which stated that there is no significant influence of class size on students' achievement in Biology was rejected. This shows that reduction in class size brought about better achievement in Biology. The finding is supported by Angrist and Levy (1999), Hoxby (2001) and Urquiola(2006). They reported that large classes do not encourage active interaction between the students and the class no matter how competent the teachers are, large class outstretches the inadequate instructional materials and place much problems on the teacher in case he/she considers improvisation. Also, Adeyefa(2000) opined that there is evidence about improvement in students' achievement that can be attributed to smaller classes.

The result of the analysis of regression showing the influence of laboratory adequacy on students' achievement in Biology displayed in Table 2 showed that there was no statistically significant influence of laboratory on students' achievement in Biology. This was in contrast with the report of Faronbi (1998) who argued the saying that 'seeing is believing' as the effect of using laboratories in the teaching and learning of science and other science related disciplines as students tend to understand and recall what they see more than what they hear. Also Ajayi (2000), Ajayi (2007) submitted that there should be a separate laboratory for each science subject for effective learning in order to improve students' achievement in science. Adeyegbe(2005) listed laboratory adequacy as one of the factors that affect the learning outcomes of students. Laboratory adequacy contributed about 2% of the variance in students' achievement in Biology is far beyond the expectation of the researchers, maybe because Biology is a natural science, whereby students are already familiar with their environment and admire it. Biology can be taught theoretically unlike other science subjects like Physics and Chemistry in which students are suppose to interact with equipments/chemical before they can be taught with the subject.

Conclusion

Based on the findings, it was concluded that government should direct its policy towards ensuring proper teacher-student ratio in order to encourage teacher-student individual interaction. Also, the laboratories in our secondary schools should be well equipped for science teaching and learning.

With the above findings it is therefore recommended that:

- The class must be sizeable to encourage teacher-student interaction for effective teaching and learning.
- The government should try as much as possible to equip science laboratories adequately well.
- Students should not see laboratory as 'no go area', they should be interested in interacting with the equipment/specimens for the purpose of clarity.

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